Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	MET:	Problem	FIAR	IFA STS-62-V-01	MPS
None	GMT:		SPR 62RF01	UA	Manager:
			IPR 65V-0003	PR MPS-2-17-1002	x39037
					Engineer:

Title: Engine 3 GH2 Flow Control Valve Sluggish (ORB)

Summary: DISCUSSION: The Main Propulsion System (MPS) Engine 3 GH2 flow control valve (FCV) responded sluggishly during the 17 commanded cycles from the low-flow position (18 percent flow) to the high-flow position (100 percent flow). The valve's response time varied from 0.2 to 0.5 second (specified limit is 0.3 second maximum) with possible valve hesitation on the last few cycles. All 17 Engine 3 GH2 FCV cycles occurred during the first 35 seconds of ascent. The problem was identified during data review for in-flight checkout performance verification by correlating the pressure upstream and downstream of the FCVs with FCV commands and the External Tank (ET) LH2 ullage pressure. The engine 1 and 2 GH2 FCVs performed nominally and overall system performance during ascent was not affected.

The Engine 3 FCV was removed prior to STS-62 and the external surfaces of the valve's poppet-sleeve assembly were wiped clean by KSC and reinstalled. Pull-in/drop-out and current signature tests after reinstallation were nominal. A second, more detailed review of data from the previous OV-102 flight (STS-58) conducted after the STS-62 anomaly was identified showed that the valve's response was slightly sluggish during the first few valve cycles. The Engine 3 GH2 FCV poppet-sleeve assembly was removed and sent to the vendor (ECC) for refurbishment. A replacement assembly was installed and retests were nominal. Failure analysis performed on the removed assembly showed moderate contamination and slight chipping of the labyrinth seal. The analysis determined that the contamination caused wear and friction resulting in a slower valve response time. The poppet-sleeve assembly was cleaned and refurbished. The labyrinth seal was later replaced after force-balance hysteresis was observed during a retest and nominal force-balance behavior was restored. The poppet-sleeve assembly is currently awaiting acceptance testing prior to reutilization. Final corrective action will be documented in CAR 62RF01-010. The OV-102 Engine 1 GH2 FCV poppet-sleeve assembly was replaced prior to STS- 62 because of similar contamination and sluggish response on STS-58. All three OV-102 GH2, FCV poppet-sleeve assemblies will be removed for inspection and cleaning during the scheduled OMDP following the Orbiter's next flight, STS-65. All three OV-105 GH2 FCV assemblies were replaced with refurbished assemblies prior to STS-59. The OV-103 and OV-104 assemblies will also be replaced with refurbished assemblies prior to the next flight of each of these Orbiters. In-flight checkout of GH2 FCV response times and postflight pull- in/drop-out and current signature testing will continue, and the Orbiter Project is processing documentation to require GH2 FCV poppet-sleeve assembly removal for inspection and cleaning at three-flight intervals. A special problem resolution

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	MET:	Problem	FIAR	IFA STS-62-V-02	APU
MMACS-01	GMT:		SPR 62RF03	UA	Manager:
			IPR 65V-0006	PR	
					Engineer:

Title: APU 3 Fuel Pump Inlet Pressure High (V46P0310A) (ORB)

Summary: DISCUSSION: About 2.5 hours after auxiliary power unit (APU) shutdown following ascent, the APU 3 fuel pump inlet pressure began cycling between approximately 300 psia and above off-scale (600 psia). Also, the test line heater effect was not reflected in the pump inlet pressure. About five hours after APU shutdown, the crew opened the fuel isolation valve for 33 minutes in an attempt to relieve the pressure back into the fuel tank, but there was no pressure equalization. This signature indicated a blocked fuel line. The heaters on the fuel feed line and tank line were switched from the A to B system about 22 hours after APU shutdown. A decrease in fuel pump inlet pressure cycles resulted primarily because of the thermostat setpoint differences in the B heater system.

About 30 hours after APU shutdown, the heat input from the test line heater was reflected in the fuel pump inlet pressure measurement. About 30 minutes later, the fuel isolation valve was opened. There was no pressure equalization for the first 10 seconds, and then the pressure slowly equalized over a 15 second period. This sluggish response indicated the blockage was loosening, but was still present in the line. The fuel isolation valve was cycled about 2 days later with the fuel pump inlet pressure below tank pressure. The two pressures equalized in less than 1 second which was a normal response. The fuel isolation valve was cycled one more time 3 days later with the fuel pump inlet pressure above tank pressure to verify flow in both directions. The pressure response was nominal. APU 3 was used for flight control system (FCS) checkout and all results and parameters were normal. APU 3 was started at Terminal Area Energy Management (TAEM) and shutdown after wheel stop with nominal performance. The run time was shortened during entry as a precaution for the remote possibility that leaking hydrazine caused the frozen fuel feed line. Water is suspected to have entered the aft fuselage through a Lexan door that covers the 50-2 access hatch during a rain storm which occurred about 13 days prior to the launch of STS-62. The water most likely entered the APU 3 fuel feed line insulation covering the tube and/or thermostats through lead wire exit holes or through openings at the lines support clamps. The water became trapped and remained between the fuel line and insulation as liquid until ascent. During and following ascent, the water froze, and then slowly sublimated. Analysis determined that only a small amount of water is required to freeze hydrazine within the tube solid in a vacuum due to the heat analysis and tests showed that pooled water would freeze the hydrazine within the 2.5 hour time period after APU shutdown. Evidence of the frozen hydrazine was indicated by the fuel pump inlet pressure transducer pressure rising until it went off-scale high beginning with the third fuel line backpressure relief cycle. After the water had completely sublimated away, the frozen hydrazine slowly thawed due to the heat input from the line heaters. Evidence of the thawing was seen when the fuel isolation valve opening response resulted in a sluggish pressure equalization between the APU fuel pump inlet pressure and the fuel tank pressure. Postflight troubleshooting began with hydrazine sniff checks all along the fuel feed line, test line, and APU 3 area. No Hydrazine leakage was found. Photographs were taken during insulation and heater removal. Resistance tests of the heater systems were nominal. The insulation and heaters were sent to Rockwell International (RI) for analysis. RI's analyses of OV-102's insulation and heaters and new insulation samples was unable to prove or disprove the water intrustion theory. The fuel lines were

inspected and measured for deformation due to frozen hydrazine No anomalous conditions were found during the troubleshooting. The fuel lines were left in place and the re-assembly of the heater systems with new hardware has been completed. CONCLUSION: The most probably cause of the anomalous fuel pump inlet pressure signature was blockage in the fuel feedline downstream of the fuel isolation valve/test line tee. Data and analysis indicate that the blockage was frozen hydrazine which subsequently thawed. The frozen hydrazine was most likely caused by heat transfer processes associated with pooled water between the fuel line and insulation which froze in the vacuum conditions and subsequently sublimated away. These heat transfer processes overcame the heat input of the fuel line heaters. CORRECTIVE_ACTION: The fuel feed line, test line, and APU were sniff checked for evidence of a hydrazine leak but none was found. The A and B fuel feed line and test line heater systems were checked with nominal results. Photographs were taken during insulation and heater removal. Visual inspection and measurement of the tubing outside diameter (O. D.) in the suspected areas determined that no obvious deformation or bulging of the tubing had occurred. After completion of the troubleshooting the APU 3 fuel system, heaters and insulation were reinstalled per drawing specification and all retest was successfully completed. Several procedural changes at KSC will be implemented to minimize Orbiter aft rain intrusion for future pad flows. Prior to vehicle assembly building (VAB) rollout, the right-hand vent doors 8 and 9 will be closed and remain closed during pad flow except when supporting other testing. At the VAB the right- hand Lexan door (50-2) will be installed and remain installed till aft close- out for flight. Mystic 7000 tape will be used to seal between the Lexan door frame and the advanced flexible reusable surface insulation (AFRSI) blankets to prevent water intrusion. A possible design change to the Lexan door is being considered to improve the sealing capabilities. In addition, the environmental conditioning system (ECS) flow to the payload bay purge circuit will be increased from 170 pounds per minute (ppm) to 230 ppm (maximum), dependent on the payload's requirements. With the increased purge flow and the right-hand side of the aft closed, the positive pressure in the aft should minimize the rain intrusion through the left-hand aft doors. If water intrusion does occur in the future, Engineering personnel will disposition the problem to determine the extent of water intrusion. If water is suspected to have pooled between the insulation and lines, the insulation will be removed (or opened) at the low point of the affected systems. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	**Time**	**Classification**	**Documentation**		**Subsystem**
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-62-V-03	OI - Sensors
INCO-01	**GMT:**		**SPR** 62RF13	**UA**	**Manager:**
			IPR 65V-0002	**PR** INS-2-17-1049	x30663
					Engineer:

Title: Anomalous APU Temperature Measurements (ORB)

Summary: DISCUSSION: At 064:01:17:39 G.m.t. (00:11:24:35 MET), the auxilliary power unit (APU) 1 fuel-pump drain-line temperature 2 measurement (V46T0170A) failed off-scale low, the APU 2 isolation valve B temperature 1 (V46T1273A) measurement failed off-scale low and the APU 3 gas-generator-valve module (GGVM) heat sink temperature (V46T1372A) measurement dropped 25 degrees F in two seconds. These measurements are loaded on dedicated signal conditioner (DSC) operational mid (OM) 01, card 21. The fourth measurement on the DSC card appeared nominal at all times and is processed by multiplexer/demultiplexer (MDM) OF03. The three anomalous measurements are all processed by MDM OF04, card 9, channels 12, 13, and 14. Each of the failed measurements uses output channel A on the

DSC card, whereas the fourth DSC measurement uses output channel B. No other measurements on the MDM OF04 card 9 exhibited similar behavior during this time frame. At 070:16:31:37 G.m.t. (07:02:38:37 MET), the three failed measurements returned to nominal readings. The nominal readings continued until 070:21:26:14 G.m.t. (07:07:33:14 MET) when the measurements returned to the failed readings. Troubleshooting at KSC isolated the anomalous measurements to a faulty DSC OM 01, card 21.

CONCLUSION: The DSC OM01, card 21 is failed. CORRECTIVE_ACTION: Card 21, serial number 319A has been removed and sent to NASA Shuttle Logistics Depot for repair. Further corrective actions will be documented on CAR 62RF13. EFFECTS_ON_SUBSEQUENT_MISSIONS: None. Complete failure of a DSC card would result in loss of its associated measurements and no operational workarounds exist to recover those measurements. Worse-case criticality of the measurements routed through DSC cards of this type is 1R3. Should the same failure recur, various redundant measurements can be used.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-62-V-04	FC/PRSD
EGIL-02	**GMT:**		**SPR** 62RF04	**UA**	**Manager:**
			IPR 65V-0005	**PR**	x38393
					Engineer:

Title: PRSD H2 Tank 6 'A' Heater Failed (FSW)

Summary: DISCUSSION: The Power Reactant Storage and Distribution (PRSD) subsystem hydrogen (H2) tank 6, heater

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Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-62-V-05	Active Thermal
EECOM-02	**GMT:**		**SPR** 62RF05	**UA**	**Manager:**
			IPR 65-V-0004	**PR**	x30770
					Engineer:

Title: Water Coolant Loop Accumulator Quantity Transducer Drift (ORB)

Summary: DISCUSSION: The Water Coolant Loop (WCL) 1 accumulator quantity transducer (V61Q2610A1) experienced a transient drop in output at 064:10:14 G.m.t. (000:20:21 MET). The quantity indication dropped from 44.9 percent to 19.5 percent over a period of 56 seconds and then recovered to 44.4 percent in about 10 seconds. A second, less severe transient was observed later in the flight. A review of data from the WCL-1 pump outlet pressure transducer, pump differential pressure transducer, and interchanger flow rate transducer, revealed no corresponding transients, which in turn confirmed that the anomaly only involved the quantity measurement, not the coolant loop.

Postflight troubleshooting, which primarily invloved cycling the accumulator and watching the quantity measurement for further transients, could not reproduce the anomaly. The WCL accumulator quantity transducers use a cable, reel, and potentiometer assembly to produce a quantity indication based on the location of the metal bellows in the accumulator, similar to the quantity measurement on the supply waste water tanks. The most probably cause for the transient involves contamination on the potentiometer windings, again similar to anomalies observed on the water tank quantity transducers. Prior experience with such transients indicates that they occur only at specific locations on the potentiometer and not over the entire range of the measurement. The accumulator quantity indication is used to monitor system health. In conjunction with pressure and temperature measurements on the same loop, the quantity measurement can help to determine if there is water leakage from the loop, loop-to-loop water leakage, or freon leakage into the loop. Complete failure of an accumulator quantity transducer only results in a loss of insight into system health and does not affect system operation. Engineering recommends continuing to fly as is until the condition worsens. The IPR will be closed as an unexplained anomaly. CONCLUSION: The most probable cause for this anomaly is localized contamination of the potentiometer windings in the quantity transducer. CORRECTIVE_ACTION: This anomaly will be closed as a Unexplained Anomaly and the accumulator will be flown as-is until the condition worsens. CAR 62RF05 has been opened against this condition. EFFECTS_ON_SUBSEQUENT_MISSIONS: Since there are currently no plans to replace or repair the measurement, it is possible that this anomaly could recur during future OV-102 flights. The effect, even if a complete failure of the measurement occurs, would be similar to STS-59, where the failed quantity indication was disconnected prior to launch. Should the anomaly occur during the launch countdown, LCC would allow the flight to procede provided the WCL-1 pump outlet pressure is functioning normally.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-62-V-06	FC/PRSD
EGIL-06	**GMT:**		**SPR** 62RF08	**UA**	**Manager:**
			IPR 65-V-009	**PR** MX-0199	x39034
					Engineer:

Title: PRSD 02 Tank 7 Failed Off-Scale High (ORB)

Summary: DISCUSSION: The Power Reactant Storage and Distribution subsystem (PRSD) Oxygen (O2) Tank 7 quantity measurement (V45Q3205A) failed off-scale high at 075:08:09 G.m.t. (011:18:16 MET) and did not recover. The failure did not affect use of the tank. When the quantity-sensor output is suspected of being incorrect, the approximate tank quantity can be determined using heater and tank fluid temperature data. The PRSD tank-quantity gaging system uses a capacitance probe and a signal conditioner which is mounted directly on the tank. No concern exists from the use of this type of instrumentation inside the tank because the 0.23 millijoules of electrical energy available from this circuit is approximately 1000 times less than the energy required to ignite the Teflon inside the tank.

Postflight troubleshooting at KSC repeated the problem and traced it to a short in the probe circuit. Although problems within the signal conditioner accounted for all prior flight failures involving PRSD tank-quantity sensors (STS-3, -4, -9, -38, and -50), this signal conditioner was verified to be functioning properly. Further troubleshooting of the quantity probe required tank removal from the EDO pallet, which in turn required removal of the pallet from the vehicle. The tank was returned to the vendor for failure analysis, however, after shipment, the shorted condition no longer existed. Testing at the vendor, including a detailed X-ray inspection of the probe, has not revealed a cause for the earlier shorted condition. Further testing is in work. The most probable cause for this condition is that transient contamination created a short in the probe circuit and then dislodged during shipment. Since it would require a fairly large piece of conductive material (about 0.5 inch long) to short across the probe inside of the tank, and it is not probable that conductive contamination of this size could be introduced to or generated within the tank, it is likely that the short is in the wiring or connector that is external to the tank. The tank will be subjected to acceptance test procedures and, provided it passes, will be returned to service. CONCLUSION: A transient shorted condition in the probe circuit external to the tank is the most probable cause of the anomaly, pending the results of failure analysis and acceptance testing. CORRECTIVE_ACTION: PRSD 02 tank 7 was removed and replaced and returned to the vendor for failure analysis which has been unable to find the problem. This analysis is being conducted under the direction of CAR 62RF08. Provided that the tank passes acceptance testing without further problems, it will put back into service. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	**Time**	**Classification**	**Documentation**		**Subsystem**
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-62-V-07	OI - Recorders
INCO-06	**GMT:**		**SPR** 62RF09	**UA**	**Manager:**
			IPR	**PR** INS-2-17-1047	x30663
					Engineer:

Title: Poor Quality Dump from Operations Recorder 2 (ORB)

Summary: DISCUSSION: Beginning at 075:00:00 G.m.t. (011:10:07), dump data from part of track 6 and all of track 7 of operations (OPS) recorder 2, serial number 1014, was of poor quality. The poor-quality dump data persisted regardless of tape direction during the dump. OPS recorder 2 continued to degrade with tracks 5, 6, 7, 8 and 10 not being usable because of excessive dropouts when recorded data were played back. OPS recorder 2 was only used during AOS periods for the remainder of the mission, thus minimizing the number of playbacks required. The OPS recorder 2 noise problems were verified during the postflight dump. The faulty recorder was removed from the vehicle and sent to NASA Shuttle Logistics Depot (NSLD) for troubleshooting.

CONCLUSION: Failure analysis has not been completed, therefore the cause of the OPS recorder noise problems is unknown at this time. CORRECTIVE_ACTION: OPS recorder 2, serial number 1014, has been sent to NSLD for failure verification and functional testing. Corrective actions will be documented on CAR 62RF09. EFFECTS_ON_SUBSEQUENT_MISSIONS: None. If an OPS recorder should completely fail, there would be some operational impacts for the INCO flight controller, but the redundant OPS recorder could be used and there would be no loss of mission data. Loss of both OPS recorders will not result in early termination of the mission per Flight Rule 11-46.

Tracking No	**Time**	**Classification**	**Documentation**		**Subsystem**
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-62-V-08	Water and Waste
EECOM-04	**GMT:**		**SPR** 62RF10	**UA**	**Manager:**
			IPR	**PR** ECL-2-A0087	x39248
					Engineer:

Title: WCS Fan Separator 1 failure (ORB)

Summary: DISCUSSION: At 077:06:29 G.m.t. (013:16:36 MET), when the crew activated the waste collection system (WCS) fan separator (FAN SEP) 1, the ac bus 1 phase A, B and C currents increased from approximately 3.3 amperes to approximately 8.1 amperes and remained at that level until the circuit breakers for FAN SEP 1 opened. The normal current signatures are aproximately 4.7 amperes at startup and 1.9 amperes during continuous running. The crew reported that FAN SEP 1 did not come up to speed, so they reconfigured to FAN SEP 2. At the request of the Mission Control Center (MCC), the crew also reported on the mode switch configuration when starting FAN SEP 1. According to the crew, they placed the mode switch in the

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Tracking No	**Time**	**Classification**	**Documentation**		**Subsystem**
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-62-V-09	MECH
MMACS-02	**GMT:**		**SPR** 62RF11	**UA**	**Manager:**
			IPR 65V-0011	**PR**	x38946
					Engineer:

Title: Failed-Off Left Vent Door 5 Open 2 Indication. (ORB)

Summary: DISCUSSION: During the vent-door open sequence after entry interface, the left- vent door 5 open 2 indication (V59K3465X) failed to indicate OPEN. The ac bus 2 currents associated with vent door 5 motor 2 showed that this motor drove the entire time that the software open-command was active (approximately 10 seconds total for the drive time). Vent door 5 motor 1 drove nominally during the open sequence.

Postflight testing duplicated the failure. The repeatability of the failure suggests that the motor 2 open limit switch has failed. CONCLUSION: The most likely cause of the anomaly was a failure in the vent door 5 motor 2 open indication limit switch that is internal to the power drive unit (PDU). The actual cause of the failure will be determined when the vent-door 5 PDU failure analysis is performed. CORRECTIVE_ACTION: The vent-door 5 PDU has been replaced, and the replacement unit successfully passed all re-test requirements. The failed PDU has been shipped to the NASA Shuttle Logistics Depot (NSLD) for failure analysis and repair. The results of the failure analysis will be documented on CAR 62RF11- 010. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	**Time**	**Classification**	**Documentation**		**Subsystem**
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-62-V-10	TPS
None	**GMT:**		**SPR** 62RF12	**UA**	**Manager:**
			IPR	**PR** FWD-2-17-4590	x38865
					Engineer:

Title: NLGD Thermal Barrier Debond (ORB)

Summary: DISCUSSION: When the Orbiter nose landing gear doors (NLGD) were opened for landing, the runway infrared camera recorded objects falling from the NLGD cavity. The objects were not recoverable because they fell into the water that is in front of KSC runway 33. During the postlanding inspection of the vehicle, the objects were verified to be a total of six NLGD chin panel thermal barriers.

At the chin panel/forward NLGD interface, nine thermal barriers are installed to prevent intrusion of hot gases during entry. The thermal barriers are bonded directly to the chin panel reinforced carbon-carbon (RCC) with ceramic cement. The thermal barriers are captive when the NLGDs are closed. The investigation of the OV-102 chin panel revealed that during the STS-62 processing flow, the chin panel was returned to the vendor, Loral, for coating repair. The chin panel received a standard application of type A sealant after the repair was completed. The fabrication requirement to remove the type A sealant from the chin panel thermal barrier bonding surface was not performed during the repair procedures. The proper procedure to remove the type A sealant is on the chin panel drawing; however, the step for removal of the type A sealant was missing from the repair procedure. The ceramic cement that is used for bonding the thermal barrier has poor adhesion to type A sealant at the high temperatures seen at the chin panel/NLGD interface. The poor adhesion quality of the cement at high temperatures caused the thermal barriers to debond, thus allowing them to fall out when the doors opened. CONCLUSION: The debond of the thermal barriers was the result of the chin panel surface not being sanded per the drawing requirements subsequent to the repair. CORRECTIVE_ACTION: The OV-102 chin panel was returned to specification. The KSC technicians sanded off the type A sealant at the thermal barrier bond site and new thermal barriers were bonded. The vendor corrective action consisted of changing the planning paper for the standard chin panel repair to include the incorporation of the removal of the type A sealant from the area where thermal barriers are bonded to the RCC.
EFFECTS_ON_SUBSEQUENT_MISSIONS: None

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	MET:	Problem	FIAR	IFA STS-62-V-11	Atmospheric Rev
EECOM-05	GMT:		SPR 62RF16	UA	Manager:
			IPR	PR ECL-0968	x30770
					Engineer:

Title: RCRS Controller 2 Bed Pressure B Sensor Drifting Low (ORB)

Summary: DISCUSSION: The regenerable CO2 removal system (RCRS) controller 2 bed B pressure sensor was biased about 1 psia from the actual pressure in the cabin. The RCRS was operated with controller 2 for the last half of the STS- 62 mission. The RCRS did not experience any shutdowns. Postflight evaluation of the pressure sensor's history showed that this sensor was biased 0.55 psia during the acceptance test procedure (ATP) two years earlier. The pressure sensor has drifted an additional 0.45 psia and is now biased 1.0 psia from the actual pressure. The trip limit for the controller to shut down based on the pressure sensors is >= 1.8 psia from actual pressure.

The RCRS has experienced problems with sensors problems with sensors, but this is the first sensor to drift. The cause of the drift is unknown; however, one theory is that the diaphragm within the sensor became stiff and hard which caused a shift in the output. The sensor will be sent to the vendor for failure analysis. If a pressure sensor were to drift enough to cause the controller to shut down, then the alternate controller can be used to maintain RCRS operations. Also, an in-flight maintenance (IFM) procedure is in place to change the bed pressure sensor in case the alternate controller fails to maintain the RCRS operation. The sensor is located on the top of the RCRS and is easily accessible after removal of the RCRS floor cover. CONCLUSION: The RCRS controller 2 bed B pressure sensor has drifted from 0.55 psia from actual at ATP to 1.0 psia from actual. The cause of the 0.45 psia drift over a two-year period could be a decrease in flexibility of the sensor's diaphragm. CORRECTIVE_ACTION: A sensor from a disassembled RCRS at Hamilton Standard will be used to replace the biased sensor. With the RCRS in place, the vendor will remove and replace the biased sensor. A functional checkout of the RCRS per OMRSD V610.020 will be performed to verify the sensor and the RCRS operation on controller 2. The sensor will be sent back to the vendor for failure analysis which will be documented in CAR 62RF16-010.
EFFECTS_ON_SUBSEQUENT_MISSIONS: None

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	MET:	Problem	FIAR	IFA STS-62-V-12	TPS
None	GMT:		SPR 62RF17	UA	Manager:
			IPR	PR VERT-1739/1741	x38871
					Engineer:

Title: Cracked TPS Tiles on the Vertical Tail (ORB)

Summary: DISCUSSION: During STS-62 postflight thermal protection system (TPS) inspections, three 22 lb/ft3 tiles were found cracked. Two of the tiles were located on the right-hand side of the tail and the third tile was located on the left-hand side of the tail. The location of the cracked tiles was near the tip trailing edge above the rudder speedbrake. Each of the tiles was 8 inches by 7 inches by 0.5 inch and each was mounted on 0.160 inch strain isolator pad (SIP). The cracks extended from the glass coating on the outer mold line (OML) to the SIP interface, which is typical of an in-plane failure. The cracks were orientated such that they followed the fore-aft direction of the structural stiffeners located beneath the inner mold line (IML) surface. The IML structure at this location consists of 0.040 inch thick skin supported with picture-frame stiffeners approximately every 6 inches in the vertical direction. Even though cracked through to the SIP, the tiles remained securely attached to the structure.

An investigation conducted by Rockwell-Downey on one of the cracked tiles from STS-62 revealed that the glass coating on the tile surface had failed in tension. An environment capable of generating this kind of failure could come from tile installation, liftoff overpressure, or inward deflection of unsupported skin during ascent and entry. A review of STS-62 flight data shows the highest structural loads occurred during ascent, therefore descent is considered the less likely culprit for the STS-62 damage. Analysis at both JSC and Rockwell-Downey indicates that the coating, if intact, accounts for over half of the .5-inch thick tile downward-bending strength. However, if this coating is compromised by cracks, its effectiveness as a structural element is significantly lessened. Hairline cracks in the glass coating as a result of installation loads, ground handling or waterproofing holes can grow with time, loads, or moisture to the point that the coating can no longer carry its portion of the nominal ascent loads and in-plane tile failure will occur. In-plane tile failure (self-dicing tile) is when a tile breaks in two pieces, remains attached to the vehicle, and continues to perform insulating functions. Coating cracks do not affect through-the-thickness (TTT) margins documented in 6.0 certification. In all three failed STS-62 tiles, the cracked surface included a waterproofing hole. A visual inspection of the cracked tile at Rockwell-Downey revealed hairline cracks, less than 1/8-inch in length, extending outward from the waterproofing hole. Testing at JSC is planned to verify that such cracks under flight load could grow in length and lead to an in-plane tile failure. Only OV-102 has 33 lb/ft3 tiles on the vertical tail. All other vehicles have Advanced flexible reusable surface insulation (AFRSI) blankets. OV-102's vertical tail structure is 0.040 inch sheet skin with picture-frame stiffeners, whereas the other vehicles' vertical tail structure is honeycomb panel. After the postflight inspections, the three tiles were removed to determine if structural damage had occurred to the vehicle. X-rays were taken and the results revealed no structural damage beneath the tiles. New tiles were bonded to the vehicle to replace the cracked tiles. CONCLUSION: The most probable cause of the in-plane tile failure was liftoff overpressure or ascent substrate deflection that was precipitated by a reduction in tile-bending strength as a result of coating cracks. CORRECTIVE_ACTION: The cracked tiles were removed and X-rays were taken of the structure. The results revealed no structural damage. New tiles have been bonded in place. Further troubleshooting analysis and test results will be documented on CAR 62RF17-010. EFFECTS_ON_SUBSEQUENT_MISSIONS: None. The events which led to this anomaly could easily recur. Coating cracks in tile are common over the entire vehicle. The in-plane failure observed after STS-62 has occurred frequently in the history of the Orbiter program (known as self-dicing tiles). The failure in no way represents a safety-of-flight issue since the tiles remain firmly attached to the vehicle and continue to perform the insulating function with no reduction in effectiveness.